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House Fuel Efficient Path Detection to Reduce Green Gas Emissions using VANET

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Abstract: ***Due to the revolution in the transport system and increasing population, the number of vehicles travelling in the road gets increasing which in turn increases the green house gas emission from moving vehicles and also causes a hike in road congestion rating. This congestion makes the travelling time longer and leads vehicle to consume more fuel which again increases the green house gas emission. this emission from the vehicle to the environment will cause a lot of problems to the society, such as it may affect the people's health and the plants life. it increases the earth temperature and leads to environmental damage. these are the unsolved problem in the transport sector. the main objective of the proposed method is to provide the solution by making the vehicle to choose the fuel efficient path among the number of paths to the same destination.***

keywords: VANET, Gas emission, Road rate, Traffic rate, NS3.

I. INTRODUCTION

Intelligent transportation system is an advanced application aims to provide the innovative services to different modes of transport and traffic management. It enables the users to be better informed, make safer and more coordinated. In the current scenario due to the increase in population, the traffic congestion is also increasing. These traffic clog results in different issues for example, clamour contamination, air contamination, traffic delay etc. Because of the air defilement and uproar pollution the ecological harming is expanding. The pollutants from the vehicle may cause immediate and long-term effects on the environment. The emissions from the vehicle cause the overall earth temperature boosting. The emissions from the vehicle depend on the fuel consumption. Gases, similar to carbon dioxide, carbon monoxide, nitrogen oxide, Hydrocarbons and particulate issue are let out by all vehicles. The impacts of the vehicle contamination are broad, influencing air, soil and water quality. Nitrous oxide adds to the consumption of the ozone layer, which shields the earth from destructive bright radiation from the sun. Sulphur dioxide and nitrogen dioxide blend with water to make corrosive downpour, which harms harvests, woods and other vegetation and structures.

These natural hurting will cause a lot of medical problems to the people group's life. An expert report demonstrated that kids who live in high traffic areas are multiple times bound to create leukemia and different malignant growths. The report has uncovered that carbon monoxide levels are multiple times higher inside a vehicle, so in this manner a lot of time stuck in rush hour gridlock will contrarily influence an individual's wellbeing [1]. The steady low-level noise which made by traffic was additionally appeared to contrarily influence youngsters' circulatory strain. Traffic blockage additionally causes a great deal of time- related pressure and stress for individuals who sit idle in rush hour gridlock [2]. There are many negative financial impacts related with traffic clog. One precedent is the downtime for trucks and other business vehicles. This increase in downtime of the vehicle during travel time will lead the engine to consume more fuel. But not only had the downtime of vehicles, the road conditions also made impacts in fuel consumption [3].

To tackle these issues which are harmful to the environment, this paper presents an **eco-friendly transport system by using vehicular ad-hoc network (VANET).** Vehicles are exchanging the data by utilizing the VANET interchanges and dependent on it they are making the move so as to diminish gas discharges without settling incredibly on movement time. The testing which has been done by the simulation compared the results with different scenarios. Different arrangements are proposed, for example, that of Sommer et al [5]. Which utilize VANET-based frameworks to send vehicles along elective courses when the streets are congested. This approach was centered on diminishing travel time and did exclude any ecological measurement vehicles to calculate the alternate routes. For that, this paper utilized the trading of data about the deferral in voyaging way and with the assistance of that exchanged data they made the vehicles to calculate the alternate routes. In this way, the vehicles in VANET(Vehicular ad-hoc Network) and the server have the contact with the help of Radio Frequency Identification (RFID).Then secured power over traffic can be done by crisis speed control, caution before path change, forward impact cautioning and so on to reduce the roadside mishap. These are clearly explained in [6]. The traffic will cause the movement time longer and cause variety in speed which prompts wasteful fuel consumption. This relationship can be found in [7].

II. PROPOSED SYSTEM

The design process includes the following steps. In the first step, a vehicle model, a traffic model and a road model are created. The travelling vehicle obtains data through the GPS sensors, speedometer and accelerometer about its position, direction and speed information. These information are stored in the road side unit which acts as a server. The traffic model keeps up the nearby traffic conditions.

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The Road Display is kept up at a focal Server and is refreshed with data on the close-by streets. The information is traded by utilizing IEEE 802.11p network [8]. The following sections discuss the various models and the successive calculations to know the fuel efficient path.

A. VEHICLE MODEL

The Vehicle Model shown in Fig.1 keeps up the qualities of the individual vehicles. The vehicle parameters, for example, sort of vehicle, mass, air opposition and moving protections are kept in the model when the vehicle is introduced. Alternate information sources are taken from the GPS sensors on the vehicle which decides the position, direction and speed. These data sources are given periodically. The yields of the model are: vehicle outflows (which are resolved normally) and position data (which are sent to other vehicles). Every vehicle sends its position and speed to the Traffic Model and to other vehicles' traffic models, inserted in VANET messages.

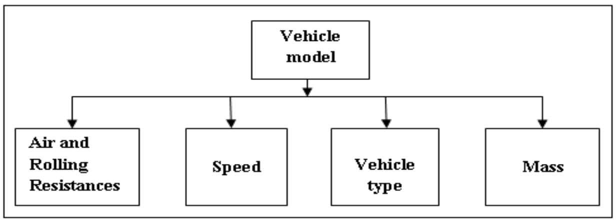

Fig.1 Vehicle model

B. ROAD MODEL

The Road Model is shown in Fig.2. The general Road Model is kept on a focal Server. This server will maintain a database which contains the information's such as road roughness, road gradient from the measurement it will be initialized but it can be changed with respect to time. These modifications with the help of accelerometers tilt sensors which are furnished with vehicles to distinguish the street surface conditions and the street angle. Data gathered by these bits of gear is utilized to refresh the Road Model. The capacity of the street demonstrated will enable the vehicles to inquiry or refresh the street qualities of every individual street section. At some point when a vehicle requires street related data, it sends a demand message with roadID as a parameter to recover the street's harshness and slope. The server- vehicle correspondences are performed utilizing IEEE 802.11p by means of the utilization of Road Side unit (RSU).

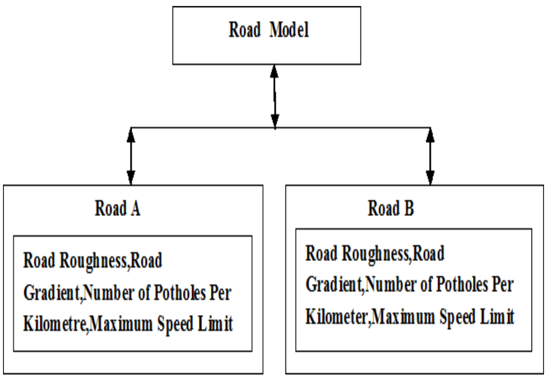

Fig.2 Road model

C.TRAFFIC MODEL

The Traffic Model shown in Fig.3 models the full traffic conditions of an area. Its purpose is to allow the vehicles to query real-time traffic conditions on each individual road segment. The inputs to the Traffic Model are road ID-s, as well as the average speed of the vehicles travelling on that road. The traffic rate of the road segments are calculated using this traffic model

The vehicles exchange messages detailing information relating to traffic conditions. The messages contain the road ID of the road they are on, their current speed and a timestamp.

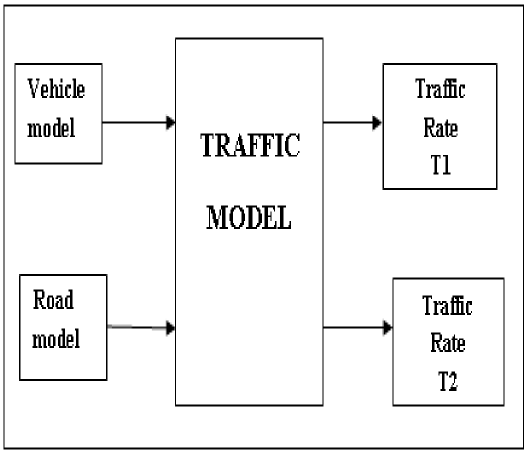

Fig.3 Traffic model

III.SYSTEM MODEL

The main aim of the system model is to ascertain the most fuel productive course by making the vehicles to choose fuel efficient path. By considering the factors such as street condition, in terms of street condition rating (R) and traffic condition, the rush hour gridlock condition rating (T). The multiplicative utility capacity [4] displayed in equation (1) relates the two parameters road rate (R) and traffic rate (T) to decide the esteem related with a street portion. T is intended to mirror the dimension of clog out and about portion with consequences for both travel time on the course and fuel utilization/gas emanations. The objective is to get benefit from the capability of every street fragment, so the closer T is to 1. T having values near zero is viewed as an indication of blockage and the vehicles will stay away from that street portion, if conceivable. Let U be the utilization factor defined by,

$$U = R/T \quad (1)$$

$$R = A.\,RR.\,V + B.\,RR.\,V^2 + C.\,V^3 + m.\,g.\,RG + m.\,a.\,V \quad (2)$$

$$T = AS/MS \quad (3)$$

In the multiplicative utilization function, R represents the Road rate which can be obtained using equation (2). T represents the Traffic rate that can be obtained from the traffic model with equation (3). Here utilization factor U is directly proportional to road rate R and indirectly proportional to traffic rate T.

In equation (2), *A* represents the rolling resistance, *RR* means Road Roughness, *V* is the Velocity of the vehicle, *B* is Rolling resistance coefficient, *C* is air Resistance of the vehicle, *m* is the mass of the vehicle, *a* is the acceleration. In equation (3) *AS* is the average speed of the vehicles travelling on the road, MS is the maximum speed of the vehicles on the road.

The Rolling resistance *A* is given by [11],

$$A = BW$$

where,

$$W = mg$$

The rolling Resistance coefficient B is given by[12].

The Air resistance of the vehicle is given by[13],

$$C = (\rho dP \div 2) \times V^2$$

where,ρ is the density of the air the vehicle moves through (kg/m^3), *d* represents the drag coefficient, P is for representing the area of vehicle the air presses in (m^2)

$$P = height \times width \text{ (of vehicle)}$$

Here velocity of the vehicle is obtained through NS-3 simulation scenario. The value of density of air the object moves through is adopted from [17]. Drag coefficient value is considered from [12].The flow chart of the proposed work is shown in Fig.4

FLOW DIAGRAM

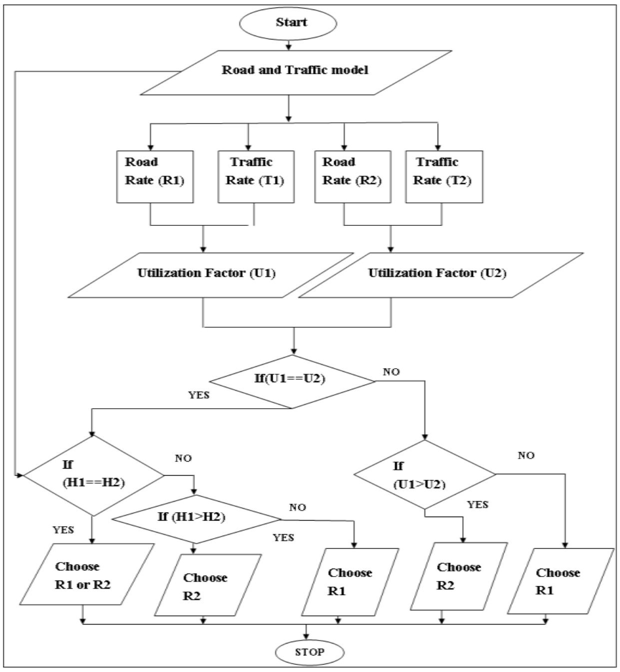

Fig 2.4 Flow Chart of the proposed work

The vehicles which are available in the VANET correspondence will provide their speed and position data of different vehicles to the traffic model. The traffic model figures the normal speed of the vehicles and keeps that until the vehicles leave that roadway. Once the vehicle left the scope of the traffic model it again register the traffic rate value. The road rate has been determined by every vehicle by utilizing equation (2).

When the vehicle wants to choose the fuel efficient path among the number of paths to the same destination, it will calculate the Road rate by considering the individual road characteristics which are obtained from the road model server.

Then the traffic rate is obtained from the traffic model for the given Road range. When the Road rate and Traffic rate are updated in the server for the individual road segments, every vehicle can estimate the available number of roads. After ascertaining the use estimate the vehicle thinks about the usage estimations of the considerable number of streets to a similar goal and afterward picks the way with less use estimate which speaks of the eco-friendly path. If there is no distinction found in estimate then the quantity of potholes distinguished per kilometer from the road model is taken for correlation which was refreshed by the vehicles along that road. In this case the vehicle made to pick the way with less number of potholes per kilometer. The potholes are identified by using the ultrasonic sensors present in the vehicle and the results are updated to the road server of specific road model.

IV.RESULTS AND DISCUSSIONS

The NS-3 simulation software is used for implementation where NS-3 is a discrete-occasion organize test system, directed essentially for research and instructive use. NS-3 is free programming, authorized under the GNU GPLv2 permit, and is openly accessible for research, improvement, and use. C++ Language is used to write the code. With the help of this software the VANET scenario has been created. VANET is a subset of MANET (Mobile ad-hoc network). In both MANET and VANET the mobile nodes are forming the network. The major difference between them is at the movement of node is unpredictable in MANET but in VANET it can be predictable. VANET is the network in which communication happens between vehicles (V2V) and vehicle to some stationary infrastructure units (V2I). These infrastructure units can be called as road side unit (RSU). For the short range communication V2V is used and for long range communication V2I is used.

The VANET scenario created in NS3 software shown in Fig.5.

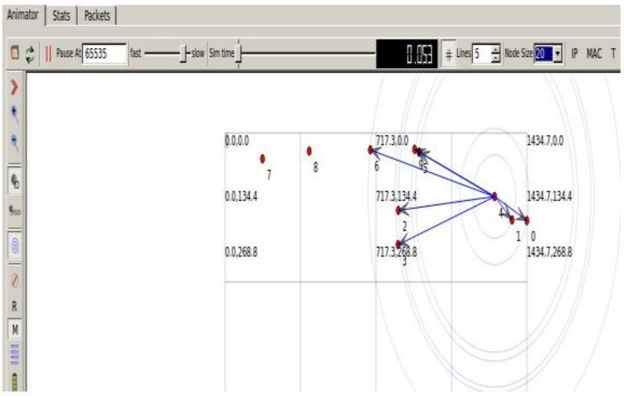

Fig.5 Vanet simulation scenario

The two road models considered are, old road and new road. During the simulation, random speed assignment is done for nodes. For the type of roads, threshold for the speed of the vehicle is assigned individually.

The two road models considered in [11] and [13]are,

OLDROA NEWROAD

the vehicle characteristics that are included in the vehicle model are rolling resistance and air resistance which are calculated using [11] and [13]. The other characteristics such as type of the vehicle, mass and frontal area are adopted from [14],[15],[16].Then the velocity of the vehicle is taken from the simulation. Based on these parameters the vehicle model was created.

The conditions of the road models such as road roughness and road gradient are adopted from [9][10].Average speed was calculated with generated speeds of vehicles for each road. Maximum speed limit for each road is fixed. Using this traffic rate for each road is calculated.

Then the U value, which is called as deciding factor, is calculated for each road by the vehicle which wants to found the fuel efficient path.

RESULTS

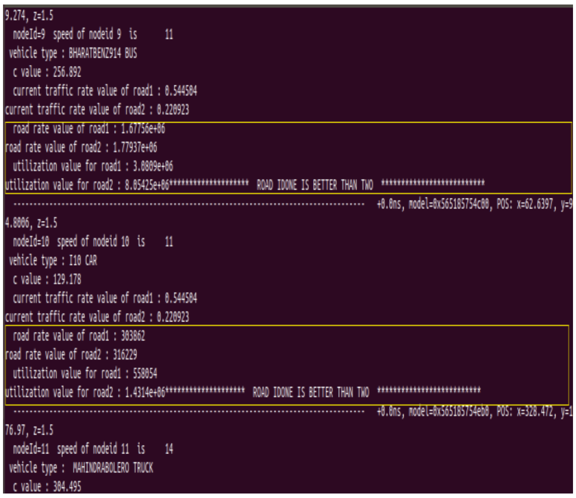

Fig. 4 For condition U1 (road 1) <U2 (road 2)

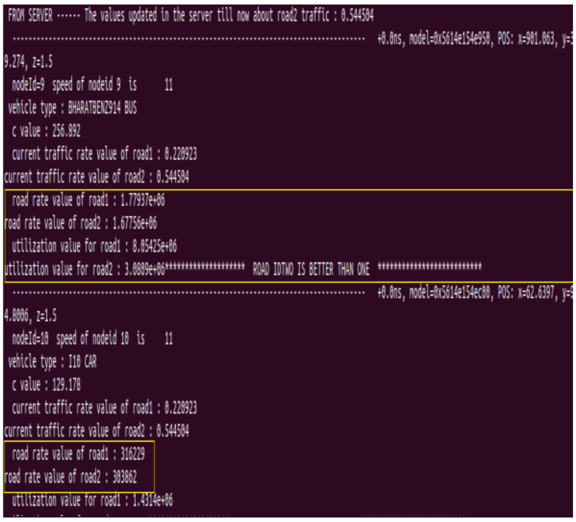

Fig.5 For condition U1 (road 1)>U2 (road 2)

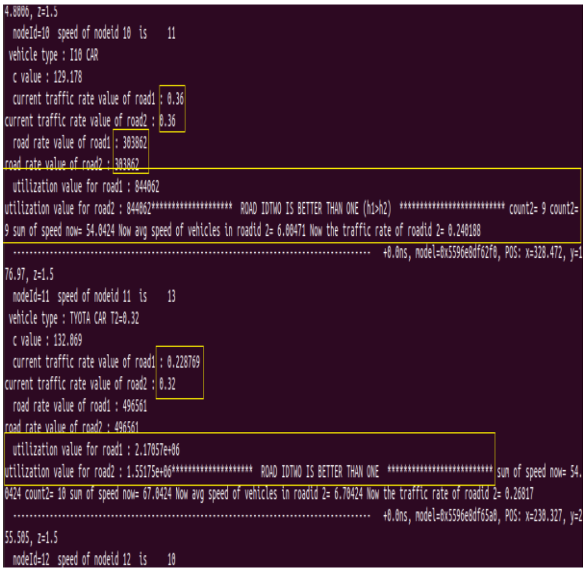

Fig. 6 For condition U1 (road 1) =U2 (road 2)

V. CONCLUSION

The VANET based communication among the vehicles is the efficient way to make the transport society to be more comfortable and safer for the users. In this paper a system is proposed system that will help in reduce the green house gas emission which outflows from the vehicle thereby reduce the pollution. The proposed vehicle model maintains an individual vehicle quality and stores it in the server for reference. The created road model gathers information about the road roughness, road gradient and kept in the data base. The traffic model is used for modeling the traffic conditions in an area. Using all these models, when a new vehicle comes to the scenario, the utilization value is measured for the created road models and then chooses the fuel efficient path among them based on the calculated utilization value. This kind of implementation of the transport system supports the fuel efficient path and so the gas emission can be reduced.

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